Title: **Simultaneous Removal of NO_x and Mercury in Low Temperature Selective Catalytic and Adsorptive Reactor**

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OBJECTIVES(s):

A one-year investigation is in progress to develop a novel Selective Catalytic and Adsorptive Reactor (SCAR) for the simultaneous removal of NO_x and mercury (elemental and oxidized) from flue gases, in a single unit operation located downstream of the particulate collectors. The proposal is based on two recent developments at the University of Cincinnati: (1) the synthesis of promising TiO_2 based transition metal catalysts for low temperature NO_x reduction; and (2) the development of a novel high-capacity chelating agent for vapor-phase mercury capture. The goal is to combine these advances to develop an integrated removal process for both pollutants. Implementation requires the attainment of the following objectives: (1) Develop a SCAR catalyst that uses CO as the reductant and is effective at approximately 160^{o}C; (2) Incorporates sites on the catalyst or adsorbent to oxidize elemental mercury; (3) Develop a chelating adsorbent that is stable up to 200^{o}C; and (4) Perform preliminary economic evaluations for industrial scale-up.

ACCOMPLISHMENTS TO DATE:

Titania supported transition metal catalysts have been synthesized and characterized. Characterizations have included measurements of BET surface area and XRD spectra. NH_3-TPD measurements have been used to study surface acidity. Based on these results, selected catalysts have been evaluated in a packed-bed reactor for the reduction of NO_x at low temperature. Studies with NH_3 and CO as the reductant have been performed. The initial results have been encouraging.

The synthesis of chelating adsorbents for mercury with stability in the temperature range 160-200 ^{o}C has been pursued. Three chelating ligands with the promising characteristics been identified. It is expected that these ligands will be stable to at least 160^{0}C. Synthesis procedures have been developed to link these chelating groups to a porous silica substrate. Measurements of the BET surface area, pore-size distribution, and thermal stability have been accomplished. The adsorbents are currently being evaluated for their ability to capture oxidized mercury in a fixed-bed adsorber.

FUTURE WORK:

The catalyst will be optimized to achieve the reduction of NO_x in the presence of SO_2 and water vapor. Additionally, strategies for simultaneously incorporating the ability to oxidize elemental mercury in the SCAR will be pursued. Once promising catalysts and adsorbents have been identified, their performance in simulated flue gases will be established. The effects of major flue gas components and temperature on pollutant removal effectiveness will be determined at typical NO_x and mercury loadings and speciation. The data obtained will be used to perform a preliminary economic evaluation to establish the potential of the technology.

STUDENTS SUPPORTED UNDER THIS GRANT:

1) Hong Lu, PhD student in Chemical Engineering
2) Lei Ji, PhD student in Chemical Engineering